Claims

1. Apparatus for generating a mist comprising:

a conduit having a mixing chamber and an exit;

a transport nozzle in fluid communication with the said conduit, the transport nozzle being adapted to introduce a transport fluid into the mixing chamber;

a working nozzle positioned adjacent the transport nozzle intermediate the transport nozzle and the exit, the working nozzle being adapted to introduce a working fluid into the mixing chamber;

characterised in that the transport nozzle includes a convergent-divergent portion therein such as in use to provide for the generation of high velocity flow of the transport fluid;

and wherein the transport and working nozzles have a relative angular orientation such that in use the working fluid is atomised and a dispersed droplet flow regime of droplets having a substantially uniform size is created in the mixing chamber by the introduction of transport fluid flow from the transport nozzle into working fluid flow from the working nozzle and the subsequent shearing of the working fluid by the transport fluid.

2. The apparatus of claim 1, wherein the transport and/or working nozzle substantially circumscribes the conduit.

3. The apparatus of claim 1 or 2, wherein the angular orientation and internal geometry of the

transport and working nozzles is such that the size of the working fluid droplets is less than 50μm.

4. The apparatus of any preceding claim, wherein the mixing chamber includes a converging portion.

5. The apparatus of any of claims 1 to 3, wherein the mixing chamber includes a diverging portion.

6. The apparatus of any preceding claim, wherein the apparatus includes a second transport nozzle being adapted to introduce further transport fluid or a second transport fluid into the mixing chamber.

7. The apparatus of claim 7, wherein the second transport nozzle is positioned nearer to the exit than the working nozzle, such that the working nozzle is intermediate both transport nozzles.

8. The apparatus of any preceding claim, wherein the mixing chamber includes an inlet adapted to introduce an inlet fluid into the mixing chamber, the inlet being distal from the exit, the transport and working nozzles being arranged intermediate the inlet and exit.

9. The apparatus of any preceding claim, wherein the apparatus includes a supplementary nozzle arranged inside the transport nozzle and adapted to introduce further transport fluid or a second transport fluid into the mixing chamber.

10. The apparatus of claim 9, wherein the supplementary nozzle is arranged axially in the mixing chamber.

11. The apparatus of claim 9 or 10, wherein the supplementary nozzle extends forward of the transport nozzle.

12. The apparatus of any of claims 9 to 11, wherein the supplementary nozzle is shaped with a convergent-divergent profile to provide supersonic flow of the transport fluid which flows therethrough.

13. The apparatus of any preceding claim, wherein the transport nozzle is shaped such that the transport fluid introduced into the mixing chamber through the transport nozzle has a divergent or convergent flow pattern.

14. The apparatus of claim 13, wherein the transport nozzle has inner and outer surfaces each being substantially frustoconical in shape.

15. The apparatus of any preceding claim, wherein the working nozzle is shaped such that working fluid introduced into the mixing chamber through the working nozzle has a convergent or divergent flow pattern.

16. The apparatus of claim 15, wherein the working nozzle has inner and outer surfaces each being substantially frustoconical in shape.

17. The apparatus of any preceding claim, further including control means adapted to control one or more of droplet size, droplet distribution, spray cone angle and projection distance.

18. The apparatus of any preceding claim, further including control means to control one or more of the flow rate, pressure, velocity, quality, and temperature of the working or transport fluids.

19. The apparatus of claim 17 or claim 18, wherein the control means includes means to control the angular orientation and internal geometry of the transport and working nozzles.

20. The apparatus of any of claims 17 to 19, wherein the control means includes means to control the internal geometry of at least part of the mixing chamber or exit to vary it between convergent and divergent.

21. The apparatus of any preceding claim, wherein the internal geometry of the transport nozzles has an area ratio, namely exit area to throat area, in the range 1.75 to 15, having an included angle α substantially equal to or less than 6 degrees for supersonic flow and substantially equal to or less than 12 degrees for sub-sonic flow.

22. The apparatus of any preceding claim, wherein the transport nozzle is oriented at an angle β of between 0 to 30 degrees.

23. The apparatus of any preceding claim, wherein the mixing chamber is closed upstream of the transport nozzle.

24. The apparatus of any preceding claim, wherein the exit of the apparatus is provided with a cowl to control the mist.

25. The apparatus of claim 24, wherein the cowl comprises a plurality of separate sections arranged radially, each section adapted to control and re-direct a portion of the discharge of mist emerging from the exit.

26. The apparatus of any preceding claim, wherein the apparatus for generating a mist is located within a further cowl.

27. The apparatus of any preceding claim, wherein the conduit includes a passage.

28. The apparatus of any preceding claim, wherein at least one of the passage, the transport nozzle(s), working nozzle(s) and secondary nozzle(s) has a turbulator to induce turbulence of the fluid therethrough prior to the fluid being introduced into the mixing chamber.

29. A spray system comprising apparatus of any of claims 1 to 28 and transport fluid in the form of steam.

30. The spray system of claim 29, further including working fluid in the form of water.

31. The spray system of claim 29 or 30, further including a steam generator and water supply.

32. The spray system of claim 31, wherein the spray system is portable.

33. A method of generating a mist comprising the steps of:

introducing a flow of transport fluid into a mixing chamber through a transport nozzle;

introducing a flow of working fluid into the mixing chamber through a working nozzle located downstream of the transport nozzle;

generating a high velocity flow of the transport fluid by way of a convergent-divergent portion within the transport nozzle;

orienting the transport and working nozzles such that the high velocity transport fluid flow imparts a shearing force on the working fluid flow; and

atomising the working fluid and creating a dispersed droplet flow regime of droplets having a substantially uniform size under the shearing action of the working fluid on the transport fluid.

34. The method of claim 33, wherein the apparatus is an apparatus according to any of claims 1 to 32.

35. The method of claim 33 or 34, wherein the stream of transport fluid introduced into the mixing chamber is annular.

36. The method of any of claims 33 to 35, wherein the working fluid droplets have a size less than 50μm.

37. The method of any of claims 33 to 36, wherein the method includes the step of introducing the transport fluid into the mixing chamber in a continuous or discontinuous or intermittent or pulsed manner.

38. The method of any of claims 33 to 37, wherein the method includes the step of introducing the transport fluid into the mixing chamber as a supersonic flow.

39. The method of any of claims 33 to 38, wherein the method includes the step of introducing the working fluid into the mixing chamber in a continuous or discontinuous or intermittent or pulsed manner.

40. The method of any of claims 33 to 39, wherein the method includes the step of introducing the

transport fluid into the mixing chamber as a sub-sonic flow.

41. The method of any of claims 33 to 40, wherein the mist is controlled by modulating at least one of the following parameters:

the flow rate, pressure, velocity, quality and/or temperature of the transport fluid;

the flow rate, pressure, velocity, quality and/or temperature of the working fluid;

the flow rate, pressure, velocity, quality and/or temperature of the inlet fluid;

the angular orientation of the transport and/or working and/or secondary nozzle(s) of the apparatus;

the internal geometry of the transport and/or working and/or secondary nozzle(s) of the apparatus; and

the internal geometry, length and/or cross section of the mixing chamber.

42. The method of any of claims 33 to 41, including mixing the transport and working fluid together by means of a high velocity transport fluid jet issuing from the transport nozzle.

43. The method of any of claims 33 to 42, including the generation of condensation shocks and/or momentum transfer to provide suction within the apparatus.

44. The method of any of claims 33 to 43, including inducing turbulence of the inlet fluid prior to it being introduced into the mixing chamber.

45. The method of any of claims 33 to 44, including inducing turbulence of the working fluid prior to it being introduced into the mixing chamber.

46. The method of any of claims 33 to 45 including inducing turbulence of the transport fluid prior to it being introduced into the mixing chamber.

47. The method of any of claims 33 to 46, wherein the transport fluid is steam or an air/steam mixture.

48. The method of any of claims 33 to 47, wherein the working fluid is water or a water-based liquid.

49. The method of any of claims 33 to 48, wherein the mist is used for fire suppression.

50. The method of any of claims 33 to 49, wherein the mist is used for decontamination.

51. The method of any of claims 33 to 50, wherein the mist is used for gas scrubbing.